IN NATURALLY REGENERATED LOBLOLLY PINE STANDS: EVALUATION OF MANAGEMENT AND ECONOMIC OPPORTUNITIES

David J. Moorhead, Coleman W. Dangerfield, Jr., and M. Boyd Edwards[1]

Abstract—The economic performance of converting 13-year-old, overstocked (> 3,000 trees per acre), naturally regenerated pine stands using precommercial thinning at a cost of $140 per acre was modeled for 25-, 35-, and 50-year rotations. The stand density was reduced to 283 trees per acre. Subsequent management scenarios recovered establishment and management costs through final harvest and in combination with periodic commercial thinnings. Indexes of financial performance were 12.3, 17.1, and 15.6 percent Internal Rate of Return; $11.13, $36.25, and $ 45.65 per acre Annual Equivalent Value; and $139.16, $453.12, and $570.66 per acre in Soil Expectation Value for 25, 35 and 50 year rotations, respectively.

INTRODUCTION

Natural regeneration of loblolly pine *(Pinus taeda L.)* is a common practice, both planned and unplanned, across the South. Landowners may harvest pine from their lands with the goal of allowing natural regeneration to establish the new stand. Typically a seed tree or shelterwood method is employed, leaving mature seed producing pines on each acre after harvest to provide seed for the new crop. Other options include seed, or seedlings in place, or seed from adjacent stands as a natural regeneration source (Edwards 1987b).

While natural regeneration methods can provide a low-cost and effective means to establish new stands, overstocking is common when favorable weather and seedbed conditions occur. Mechanical strip thinning is a recommended practice usually by age 3 to 5. Costs associated with precommercial thinning increase as stands age.

METHODS

Data from a precommercially thinned (PCT) natural regeneration study site on the USDA Forest Service, Hitchiti Experimental Forest, in the Piedmont of Georgia was used to project expected, potential woodflow and financial performance for 25-, 35-, and 50-year rotations.

The stands were established using (1) clearcut method with seed in place, (2) seed tree method, and (3) shelterwood method in 1983 (Edwards 1987b). Following harvest, all hardwood stems 1 inch in diameter at breast height (d.b.h.) and larger were treated by injection with Tordon 101. In the summer of 1996, the stand was precommercially thinned by hand crews using chainsaws to an approximate 12 by 12 foot spacing (302 trees per acre). Following the PCT, measurements of crop tree d.b.h., height, and density were made.

The three management scenarios were modeled using YIELDplus 4.0 (Hepp 1994). Stand inputs from the PCT plots were used in a natural loblolly pine growth and yield simulator. Site index at age 50 was 90 feet (Edwards and Dangerfield 1990). The following financial parameters were set: a 28 percent marginal Federal tax bracket, 8.0 percent before-tax discount rate, $22 per cord for pulpwood, $58 per cord for chip and saw (CNS), and $200 per thousand board feet Scribner for sawtimber. Stumpage prices were inflated at 3.5 percent for pulpwood and CNS, and 4.0 percent for sawtimber over the rotation.

Per-acre management costs included $5 for site preparation burning, $40 for herbicide treatment, and $140 for the PCT. Beginning in 1997, per-acre charges for prescribed burns/fire breaks at 3-year intervals were accessed at $8 for the initial burn, $6 for the second burn, and $5 for the subsequent burns. Total harvest expenses were computed at 12.5 percent of the harvest value, including 10 percent for marketing and 2.5 percent for ad valorem property taxes on timber harvested.

Three management scenarios were examined: a 25-year rotation without thinning, a 35-year rotation with thinning at age 28, and a 50-year rotation with thinning at ages 30 and 40. All thinning treatments were low thinnings to a residual basal area of 65 square feet per acre. Thinnings were set in order to maintain medium to low stand risk to southern pine beetle infestations, and volume removed had to meet a minimum 5 cords per acre to be considered commercially feasible.

RESULTS

Prior to the PCT at age 13, the stand averaged 5,086 stems per acre (3,050 to 8,910). Following the PCT, an average of 283 crop trees remained per acre with average height of 3.85 inches at d.b.h. and 23.24 feet in overall height. These data were used to manually set the initial stand parameters in the model.

[1] Associate Professor, Forest Regeneration, D.B. Warnell School of Forest Resources, The University of Georgia, P.O. Box 1209, Tifton, GA 31793; Associate Professor, Agricultural and Applied Economics, The University of Georgia, College of Agricultural and Environmental Sciences, Athens, GA 30602; and Research Ecologist, USDA Forest Service, Southern Forest Experiment Station, Athens, GA 30602 (respectively).

stand conditions present at harvest, residual stand components (if applicable), and harvested stand components for each rotation scenario are presented in table 1. Financial performance (before tax, adjusted for inflation), indicated by the Internal Rate of Return (IRR), Annual Equivalent Value (AEV), and Soil Expectation Value (SEV) is detailed in table 2.

25-Year Rotation

A final harvest was projected for 13 years after the PCT (table 1). Stems averaged 62 feet tall. The stand had a basal area of 83 square feet on 210 merchantable stems per acre. Total volume per acre averaged 25.33 cords, with the chip-and-saw component contributing 5.29 cords per acre.

The investment earned a 12.3 percent IRR, with an AEV of $11.13 per acre. The SEV was $139.16 per acre (table 2).

35-Year Rotation

A commercial thinning was projected at age 28, 16 years after the PCT (table 1). At the first thinning at age 28, the trees averaged 67 feet in height with a basal area (BA) of 65. An average of 83 pulpwood stems per acre were harvested, yielding 10.34 cords per acre.

At final harvest at age 35, trees averaged 77 feet tall. The stand has a BA of 91 in 107 stems. A total of 32.90 cords was projected per acre. The product mix shifted to chip and saw (CNS) and sawtimber with 25.13 cords and 7.77 cords, respectively. The 35-year rotation produced a total of 43.24 cords per acre in the two harvests.

The IRR equaled 17.1 percent with an AEV of $36.25 per acre, and a SEV of $453.12 per acre (table 2).

50-Year Rotation

Two commercial thinnings were projected at ages 30 and 40, 18 and 28 years after the PCT, respectively (table 1). At the first thinning at age 30, the stand was projected to accumulate a BA of 106 on 190 stems averaging 70 feet in height. This thinning produced 13.61 total cords per acre with 9.75 cords of pulpwood, and 3.86 cords of CNS.

The stand was projected to accumulate a BA of 99 by the second thinning at age 40. This harvest removed 12.54 cords per acre. Pulpwood classes had been removed in the first thin and CNS totaled 3.33 cords, with sawtimber totaling 9.21 total cords per acre.

At final harvest at age 50, the stand had accumulated a 90 BA on 55 stems averaging 90 feet in height. This harvest produced 36.49 cords per acre of sawtimber. Overall, a total of 62.65 cords per acre was removed in the three harvests over a 50-year rotation.

The IRR was 15.6 percent. Annual Equivalent Value was projected at $45.65 per acre with a $570.66 per acre SEV (table 2).

DISCUSSION

Many landowners may be hesitant to invest $140 per acre in a 13-year old natural pine stand. However, the financial performance expected following a relatively high investment were promising. Internal rates of return ranging

Table 1—Projected per acre stand parameters and woodflow of naturally regenerated loblolly pine at 25-, 35-, and 50-rotations

	Stand condition			Residual component			Harvested component		
Rotation length	Age	Height	PAI[a]	Basal area	Stems	Total cords	Basal area	Stems	Total cords
25 years	25	62	1.0	—	—	—	83	210	25.33
Final harvest totals per acre							83	210	25.33
35 years	28	67	1.1	65	114	21.30	33	83	10.34
	35	77	1.7	—	—	—	91	107	32.90
Final harvest totals per acre							124	190	43.24
50 years	30	70	1.2	65	99	22.28	41	91	13.61
	40	82	1.5	65	55	24.79	34	38	12.54
	50	90	1.2	—	—	—	90	55	36.49
Final harvest totals per acre							165	184	62.65

regenerated loblolly pine at 25-, 30-, and 50-year rotations

Rotation	Internal Rate of Return	Annual Equivalent Value	Soil Expectation Value
	Percent	*-----Dollars per acre ----*	
25 year	12.3	11.13	139.16
35 year	17.1	36.25	453.12
50 year	15.6	45.65	570.66

from 12.3 to 17.1 percent present attractive investment opportunities. Even with extending the rotation length, income from the periodic thinnings offset the carrying costs of the investment. Over time, SEV increased as the thinnings and final harvests produced greater proportions of more valuable CNS and sawtimber stumpage.

Stands that are densely stocked are expected to stagnate and/or produce only marginal yields (Mann and Lowery 1974). Precommercial thinning is generally recommended at young ages (by age 3) when mechanical equipment can be effectively used to strip-thin at relatively low costs per acre (>$45). Despite the high cost of the PCT, it could be treated as a capital expense in the year of treatment as opposed to a site preparation or reforestation cost.

quality crop trees to be favored. Selection criteria should include: preferred species, superior bole form (straightness, single stem, branch angle), absence of bole cankers and other stem damage, and selection of trees with dominant terminals and live crown ratios of > 40 percent. Selection of high-quality crop trees for chain and saw and sawtimber production can justify higher PCT expenses.

LITERATURE CITED

Edwards, M.B. 1987a. A comparison of natural regeneration alternatives for a loblolly pine forest in the lower Piedmont of Georgia. In: D.R. Phillips, comp. Proceedings of the fourth biennial southern silvicultural research conference. Gen. Tech. Rep. SE-42. U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station: 84-86.

Edwards, M.B. 1987b. A loblolly pine management guide: natural regeneration of loblolly pine. Gen. Tech. Rep. SE-47. U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 17 p.

Edwards, M.B.; Dangerfield, C.W., Jr. 1990. Reliable, low-cost alternatives for pine regeneration in the South. Res. Pap. SE-280. U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 6 p.

Hepp, T.E. 1994. YIELDplus 4.0 timber forecasting and planning tool. Norris, TN: Tennessee Valley Authority. 120 p.

Mann, W.F., Jr.; Lohery, R.E. 1974. Precommercial thinning of southern pines. Journal of Forestry. 72: 557-560.

Proceedings of the Ninth Biennial Southern Silvicultural Research Conference

Edited by
Thomas A. Waldrop

Clemson, South Carolina
February 25-27, 1997

Hosted by
Clemson University
USDA Forest Service, Southern Research Station

Sponsored by
Alabama A&M University
Clemson University
Historically Black Colleges and Universities Program
National Association of Consulting Foresters of America
National Association of Professional Forestry Schools and Colleges
National Hardwood Lumber Association
Society of American Foresters
Southern Group of State Foresters
Southern Industrial Forest Research Council
USDA Forest Service, Southern Research Station
University of Arkansas, Monticello

Published by
USDA Forest Service
Southern Research Station
Asheville, North Carolina